Integrating Rational Functions

While working in a group make sure you:

- Expect to make mistakes but be sure to reflect/learn from them!
- Are civil and are aware of your impact on others.
- Assume and engage with the strongest argument while assuming best intent.

1.
$$\int \frac{\frac{-1}{10}}{x+2} dx$$
 $\int \frac{\frac{1}{5}}{2x-1} dx$

2. Generalize the above examples, that is, describe your strategy for integrating rational functions of the form $\frac{a}{bx+c}$ where a, b, and c are constants.

3.
$$\int \frac{x}{x^2 + 2} \, dx$$
 $\int \frac{4x}{5x^2 + 7} \, dx$

4. Generalize the above examples, that is, describe your strategy for integrating rational functions of the form $\frac{ax}{bx^2+c}$ where a, b, and c are constants.

Important derivative!!! (my favorite function!!)

$$\frac{d}{du}\arctan(u) = \frac{1}{u^2 + 1}.$$
5.
$$\int \frac{1}{x^2 + 4} dx$$

$$\int \frac{2}{9x^2 + 1} dx$$

For each factor of the form $(px+q)^m$, the partial fraction decomposition must include the following sum of *m* fractions:

$$\frac{A_1}{px+q} + \frac{A_2}{(px+q)^2} + \frac{A_3}{(px+q)^3} + \dots \frac{A_m}{(px+q)^m}$$

For each factor of the form $(ax^2 + bx + c)^n$, the partial fraction decomposition must include the following sum of m fractions:

$$\frac{B_1x + C_1}{ax^2 + bx + c} + \frac{B_2x + C_2}{(ax^2 + bx + c)^2} + \frac{B_3x + C_3}{(ax^2 + bx + c)^3} + \dots \frac{B_nx + C_n}{(ax^2 + bx + c)^n}$$

Example:
$$\int \frac{x^3}{x^2 + 4x + 3} \, dx$$